Space Weather Technical Forecast

Issued on Friday, 07 June 2024 at 00:12 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Isolated M-flares remain likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate during the last 24 hours with an M6.1 flare occurring at 06/1506 UTC associated with AR3697, though with some contribution from an as yet unseen region around the eastern limb. There are eight visible sunspot regions, with six currently numbered. AR3697 has stalled in terms of changes to the overall areal size of its penumbra, and now consists of a negative penumbral area sandwich between two positive regions. Weak umbral development in the westernmost of these positive regions has resulted in the currently delta-configuration. AR3703 has also seen the small delta within its trailer persist, but remained largely inactive with no other growth or complexification. Slow development is also ongoing in the westernmost of the two spots new spots near the east limb, while there are some signs of a larger region soon rotating onto the southeast disc, however this will be impossible to fully assess for at least another 24-36 hours.

There were no Earth-directed CMEs observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by ACE at L1, have been at background or near background levels throughout, ranging 360-410 km/s. Density eased to below average values. The Interplanetary Magnetic Field (IMF), Bt, remained weak, at 7nT or below, with the north-south component varying weakly between +6 and -5nT, favoring a negative (southward) direction initially. Phi angle was negative (toward the Sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 persisted at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels with the associated 24-hour fluence well below Active. Observed fluence at 07/0000 UTC was 1.49e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Occasional Moderate activity is likely with isolated M-flares and a slight chance of X-class flares. These most likely from AR3697, or perhaps new regions moving onto the Earth-facing disc.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. The next potential enhancement is likely to be from CH42/+, which could bring slightly elevated or possibly elevated wind speeds later on day 2 or perhaps more likely on day 3 (08-09 Jun) onwards, although this is low confidence. Overall, Quiet geomagnetic activity is expected, increasing to give a spell of Unsettled with Active intervals with any coronal hole fast wind onset.

Energetic Particles / Solar Radiation: High energy proton flux is expected to persist at background levels, with a slight chance of rising above the S1/Minor Radiation Storm threshold

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throughout given any notable flares. High energy electron flux is forecast to persist at background levels, with the associated 24 hour fluence forecast to remain below the Active threshold.

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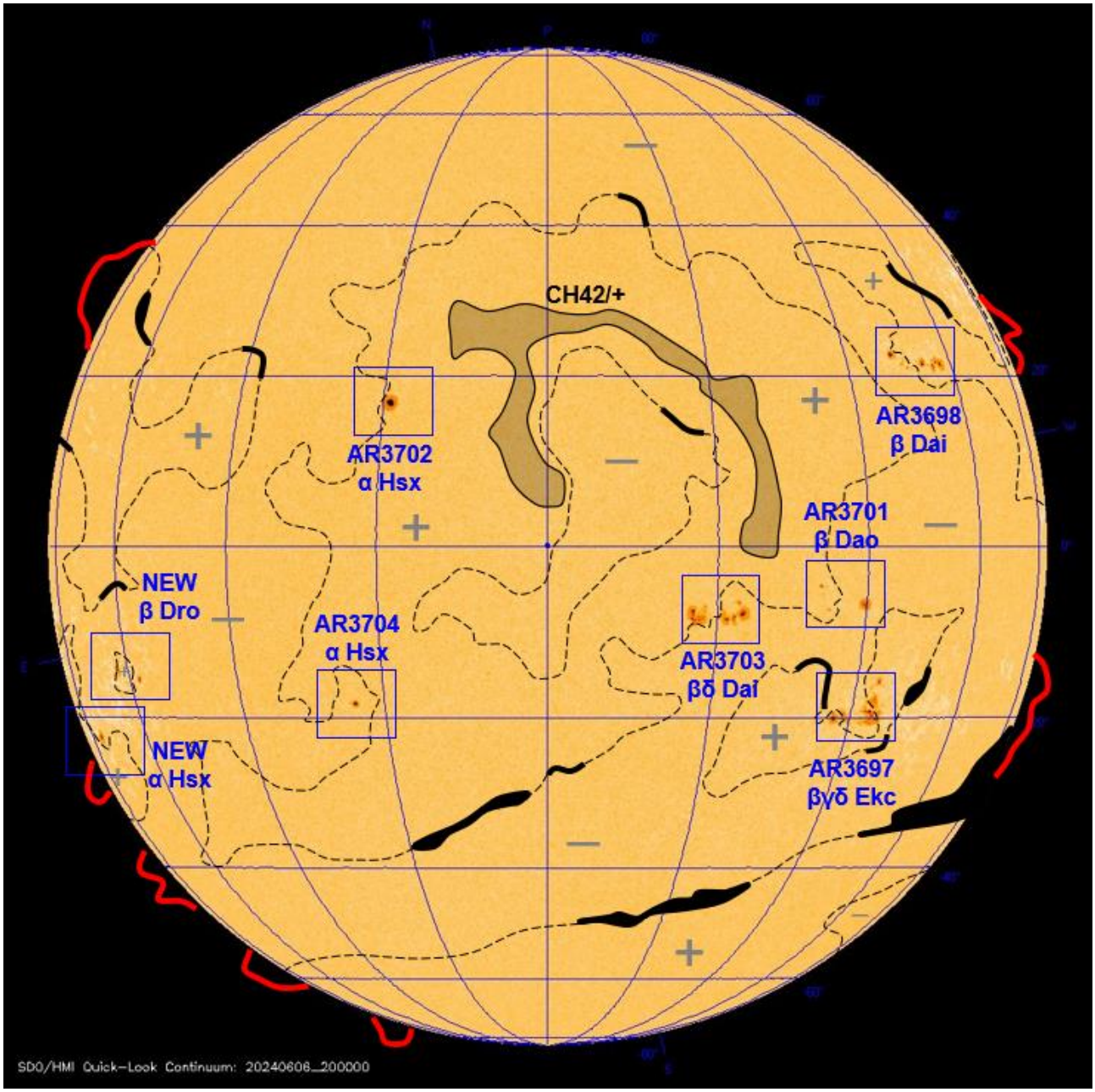
Figure 1. Solar Analysis Valid 06/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are currently no Earth-directed CMEs expected.

Recent slightly elevated solar winds have now eased to background levels. The next potential enhancement is most likely to be from the elongated CH42/+ currently just west of the north-centre disc, which could bring slightly elevated or possibly elevated wind speeds later on day 2 (08 Jun) or perhaps more likely into day 3 (09 Jun) onwards. This is low confidence, however, due to limited enhancement currently indicated in MOSWOC ENLIL model output and the lack of evidence from the previous rotation, which was dominated by the arrival of fast CMEs. Any geomagnetic response is expected to be limited however.

Overall, generally Quiet geomagnetic activity is expected, but with the potential for spells of Unsettled to Active conditions from any coronal hole fast wind onset, and a slight chance of G1/Minor Storms on days 2-4 (08-10 Jun). This as a potential result of a stronger than expected fast wind onset or CME enhancement should we see CME activity in the near term, with multiple sunspots and filaments now in a potentially Earth effective location.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil

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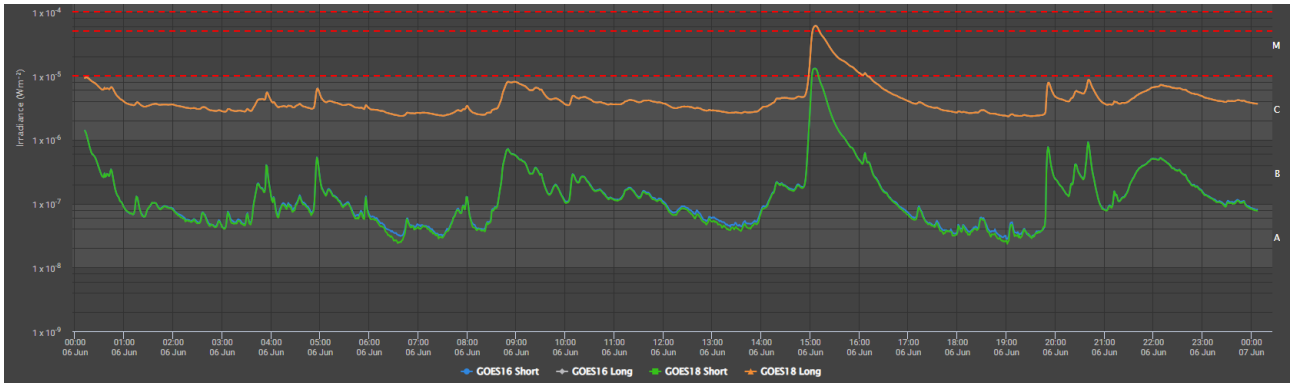
Radio Blackouts - X-Ray Flares:
Further periods of Moderate activity are likely with an ongoing chance of M-flares, primarily from AR3697 in the southwest or new regions likely rotating onto the southeast disc. There remains a slight chance of isolated X-class flares throughout pending further developments.

AR3697 is now a medium sized spot with only limited development occurring. The region maintains a delta configuration however with a complex magnetic structure above the spot evident in SDO imagery. AR3703 also has a very weak delta configuration, due to a very small negative umbra developing south of its trailer, however some consolidation of the intermediate regions into the main leader and trailer spots is ongoing. These regions will be approaching the western limb by the end of the period, however there is also flux emergence on the southeast disc, with the development of a new spot and a further more mature region rotating onto the disc and further regions have the potential to rotate onto the disc through the period. For now the flare risk is maintained through the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	60	60	60	60
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 2: Latest 24hr GOES16/18 X-ray flare trace.



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Solar Radiation Storms - (High Energy Protons):
GOES-18 proton flux is currently at background levels. AR3697 is now much reduced compared to its previously active phases, but still maintains the potential for further flares, albeit most likely at M-class. Alongside the other active regions, the majority of which are in the western disc, this gives a slight chance of proton flux exceeding the S1/Minor Radiation storm level though the period, even as they begin to rotate away beyond the western limb by day 4 (10 Jun).

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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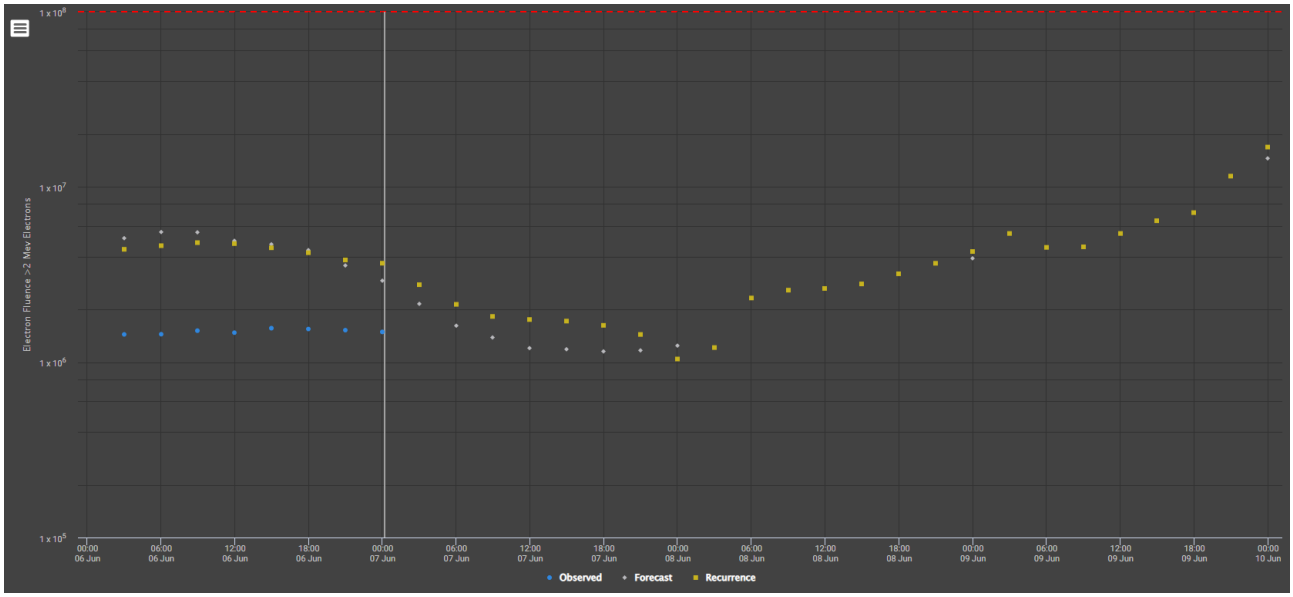
High Energy Electrons Event (≥ 2MeV):
The high energy electron flux, as observed by GOES-16, is expected to persist at mainly background levels, with no notable sources of potential enhancement currently anticipated. The associated 24 hour electron fluence is expected to remain well below the Active level with MOSWOC REFM output viewed as generally good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: Latest MOSWOC REFM model output.



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